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Unemployment, Unsatisfied Demand for Labor, and Compensation Growth in the United States, 1956-1980*

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ABSTRACT

This paper presents two key facts which call into question the value of unemployment rates as barometers of labor market tightness. First, while both unemployment rates and unsatisfied labor demand proxies perform reasonably well on their own in compensation growth equations, in models which include both, only the unsatisfied demand variable appears to matter. Second, the past decade's outward shifts in Phillips plots can to a substantial degree be tied to outward shifts in plots pairing the relevant unemployment rate and unsatisfied demand proxies. The paper also provides results which indicate that Phillips relationships which are defined in terms of unsatisfied demand variables appear to be somewhat more stable than those using unemployment rates.

Taken together, our findings have a clear message for those concerned with macroeconomic theory and policy: labor market pressure on wages can be more reliably assessed by looking at measures of unsatisfied labor demand than by looking at the unemployment rates which have played the key role in most earlier analyses.

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Virtually all empirical analyses of short run aggregate wage growth have an unemployment rate at their heart.[1] What lies behind the expected inverse relationship between unemployment and the rate of growth in wages? The following quotation clearly presents the standard rationale for including an unemployment rate variable in wage growth regressions: "In a given labor market, wages tend to rise under conditions of excess demand, fall with excess supply, and remain constant when excess demands are zero. Since the aggregate unemployment rate is a good indicator of the general state of labor markets, as unemployment decreases, more and more markets come into a state of excess demand and the general pace of wage inflation increases."[2]

For an unemployment rate to in fact be "a good indicator of the general state of labor markets," two conditions must be satisfied. First, a given unemployment rate must represent the same number of available units of labor at each point in time. Second, the relationship between the number of available units of labor and labor market tightness must remain constant, which implies that there must be stability in the relationship between number of units of labor available and unsatisfied labor demand. Thus, if the unemployment rate does not mirror the number of available units of labor or if the importance of structural unemployment changes over time, the unemployment rate will not be a good indicator of wage pressure from labor market imbalance.

This paper presents evidence concerning the use of various unemployment rates as barometers of tightness in the labor market. In Section I, we demonstrate that proxies for the unsatisfied demand for labor (the help

wanted index and the manufacturing quit rate) perform at least as well as either the official or the prime age male unemployment rate when entered alone in wage growth regressions. Moreover, we find that in regressions which include both an unemployment rate and a measure of unsatisfied labor demand, the unemployment rate does not matter while the unsatisfied demand proxy does. The second section presents evidence which strongly suggests that, at least for the United States, a substantial fraction of the growing instability in Phillips relationships (again defined in terms of either the official or prime age male unemployment rates) can be linked to growing instability in the relationship between unsatisfied labor demand and the relevant rate of unemployment. Furthermore, the relationship between our unsatisfied demand proxies and the rate of compensation growth appears to have been more stable than the relationship between unemployment and the rate of compensation growth. In sum, measures of employers' unsatisfied labor demand dominate measured unemployment rates as indicators of wage pressure emanating from labor market conditions. Section III discusses the interpretation of our empirical findings. The paper's concluding section discusses the main implication of our analysis for macroeconomic theory and policy, that labor market pressure on wages can be more reliably assessed by looking at measures of unsatisfied demand than at the unemployment rates which have played the key role in earlier analyses, and emphasizes the need for new microdata if we are to fully understand why.

I. Compensation Growth and Its Correlates

Most economists would think it important to consider the role of "tight" versus "loose" labor markets as part of any study of wage growth. Since the appearance of Phillips' very influential 1958 article, most econometric analyses of wage growth have attempted to gauge the degree of labor market tightness with an unemployment rate variable. An alternative approach would be to use available proxies for the unsatisfied demand for labor to assess how tight labor markets are. In this section, two such variables are experimented with. These unsatisfied demand variables perform well when they replace the unemployment rate in standard compensation growth equations. Of greater interest, however, is the finding that in compensation growth equations which include both an unemployment variable and an unsatisfied demand proxy, only the unsatisfied demand variable matters.

Model Specification

While the rationale for including an unemployment rate variable in wage growth equations is not always clearly stated, the most prevalant notion seems to be that the unemployment rate should be highly correlated with the degree of excess demand in the labor market. A similar argument might be made regarding the inclusion of some measure of employers' unsatisfied demand for labor in place of an unemployment rate variable. A priori, such a measure should be at least as likely as any unemployment rate to be highly correlated with the excess demand for labor.

The labor market variable which has most commonly appeared in wage growth equations is the official unemployment rate. One important question

is whether the official (total civilian labor force) unemployment rate adequately reflects the availability of qualified potential employees. Various researchers have argued that women and teenagers are less likely to possess, or to be seen as possessing, requisite job skills and commitment than prime age males. This line of reasoning has lead many to believe that the prime age male (men 25 to 54) unemployment rate might be a better variable to use in wage growth equations than the official rate.

As mentioned above, measures of the unsatisfied demand for labor could be substituted for the unemployment rate in wage growth models. One likely candidate for the job of measuring the degree to which employers' demands for labor are unsatisfied is the job vacancy rate. Another possible unsatisfied demand measure is the fraction of employers' work forces choosing to leave their jobs during a given time period. Some job vacancies arise because a new job has been created rather than because someone has quit and the job vacancy rate reflects both the flow and the duration of job openings, so that the vacancy rate and the quit rate will not mirror each other perfectly. Nonetheless, the quit rate should be highly correlated with the seemingly better unsatisfied demand proxy, the vacancy rate.

The first compensation growth equations presented in this paper include either an unemployment rate:

$$(1) \quad \dot{w}/w = \alpha + \beta(1/u) + \sum_{j=1}^{n} \lambda_j (\dot{p}/p)_{t-j}$$

or an unsatisfied demand variable:

$$(2) \quad \dot{w}/w = \alpha + \gamma(1/d) + \sum_{j=1}^{n} \lambda_j (\dot{p}/p)_{t-j},$$

where $\dot{w}/w$ is the rate of growth of nominal hourly compensation, u is the chosen unemployment rate, d is the chosen unsatisfied demand proxy, $(\dot{p}/p)_{t-j}$ is the rate of inflation in period t-j, and α, β, γ and the λ_j are regression coefficients.

The reasoning behind including labor market variables in wage growth equations stated above implies that $\hat{\beta}$ should be positive (unemployment negatively related to the rate of wage growth) and that $\hat{\gamma}$ should be negative (unsatisfied demand positively related to the rate of wage growth).

One way to ascertain whether unemployment rates or our unsatisfied demand proxies represent better measures of labor market tightness might be to include both together in estimated Phillips-type equations. For this reason, perhaps the most interesting wage growth regressions presented in this paper are those which include both an unemployment rate and a measure of unsatisfied demand. The relevant regression model can be written as:

$$(3) \quad \dot{w}/w = \alpha + \beta(1/u) + \gamma(1/d) + \sum_{j=1}^{n} \lambda_j (\dot{p}/p)_{t-j} ,$$

where all the variables are defined as above.

The Role of Inflation

We have included either four or sixteen lagged inflation values ($(\dot{p}/p)_{t-j}$ terms) in the compensation growth equations presented in this paper instead of a single variable intended to capture the expected rate of inflation in the current period ($(\dot{p}/p)^{e}_{t}$). There are several considerations which lead us to this course of action.

First, there is no generally accepted expected inflation series which we could have used even had we wanted to. The usual approach to generating an expected inflation series is to assume that people expect a current rate of inflation equal to some distributed lag function of past inflation, with the distributed lag weights based on previous inflation history. This seems unrealistic insofar as many factors other than past rates of inflation will have an effect on current inflationary expectations. One way to construct a more realistic expected inflation series might be to survey a random sample

of the population on a regular basis, asking those surveyed what they expect the average rate of inflation to be over the period until the next such survey. Unfortunately, reliable data of this sort have not been collected.[3]

Suppose we could have obtained a time series which accurately captured expectations each period regarding the rate of inflation in the immediately subsequent period. Even if the rate of wage growth reflected only labor market conditions and expectations regarding inflation, more than the single expected inflation variable just described should play an important role. For one thing, in a world where union wage contracts are typically set for three years at a time, some period t wage changes may reflect period t price change expectations generated up to three years earlier, rather than period t price change expectations based on information through period t-1. A similar situation will exist in nonunion establishments to the extent that across-the-board wage increases may occur only at annual intervals. Entering a large number of lagged inflation terms (we experiment with as many as sixteen) may allow us to capture the price change expectations which should have existed at the time the oldest union contract still in force as of period t would have been negotiated, at least to the extent that price change expectations are a function of past price changes. Including a single $(\dot{p}/p)^e_t$ variable based on a rolling ARIMA or other mechanistic model using price data through period t-1 would have been considerably more restrictive.

Perhaps more fundamentally, there is no clear reason why quarter t wage changes should reflect only quarter t expected price changes. Particularly where workers remain attached to the same employers over relatively long time periods,[4] money wages may reflect the expected pace of inflation over some longer horizon but not necessarily during a single quarter. One would expect the parties negotiating a wage bargain in period t to be concerned about the

expected rates of inflation in periods t, t+1, t+2, and so on through period t+n, the end of the relevant time horizon. Again, entering lagged inflation terms rather than a single $(\dot{p}/p)^e_t$ term based on inflation through period t-1 allows added flexibility; the coefficients on lagged price terms may reflect their influence on longer term as well as on current period inflationary expectations.

Finally, to the extent that inflation is not always perfectly foreseen, past rates of inflation may play an important role in their own right rather than solely because they influence expectations. Under many union contracts, cost of living adjustment (COLA) clauses provide for wage increases tied directly to the rate of inflation; union members covered by COLA clauses are thus at least partially protected against unforeseen price increases. Where prices have grown faster than wages, both union and nonunion workers may receive "catch-up" wage increases that are independent of what the rate of inflation is expected to be in the future. The existence of both COLA and "catch-up" wage increases provides an additional rationale for including lagged inflation terms in wage growth equations.

To summarize, the two main reasons we chose to specify our wage growth equations with lagged inflation values rather than a single $(\dot{p}/p)^e_t$ variable are, first, that no generally accepted expected inflation series is available and, second, that the relationship between inflation and wage growth is almost certainly much more complicated than could be captured by including a single price expectations variable in the model.

Data Used for Model Estimation

Throughout this study, we use both the official unemployment rate (which refers to the entire civilian labor force) and the prime age male unemployment rate (which refers only to male civilian labor force members who are between 25 and 54 years old). Two variables serve as unsatisfied demand proxies (the d variable in equations (2) and (3)): the help wanted index and the manufacturing quit rate. The help wanted index is used as a vacancy surrogate since no suitable vacancy series is available. This index is based on counts of help wanted advertisements printed in the classified sections of leading newspapers in approximately 50 Standard Metropolitan Statistical Areas.[5] One potential problem with using the help wanted index rather than actual vacancy data is that affirmative action pressures may have led to greater advertising of available job openings, particularly after the AT&T consent decree was signed in 1973, so the help wanted index may have trended upwards relative to the number of vacancies. Any decline in the price of newspaper advertisements relative to the price of other methods of recruiting employees would also have a similar effect. The fact that forces other than affirmative action can affect the amount of help wanted advertising done by employers is consistent with the paths of the normalized Canadian help wanted index and Canadian job vacancy rate during the period from the beginning of 1971 through the end of 1978; the help wanted index seems to have trended upwards somewhat relative to the vacancy rate after 1974. Note that the help wanted index as reported by the Conference Board is a proxy for number of vacancies, not the vacancy rate; to create a variable that we could use as a rate proxy, we divided the published help wanted index by the number of employees on nonagricultural payrolls.[6] Monthly quit

rate information exists only for the manufacturing sector; these data are collected by the Bureau of Labor Statistics (BLS) in its "Monthly Report on Labor Turnover".[7]

Recall that our estimating equations are written with the rate of growth in nominal compensation as the dependent variable and lagged inflation terms on the right hand side. The hourly compensation series we used for calculating $\dot{w}/w$, the rate of growth in nominal compensation, was generated by BLS; they divided total compensation of nonfarm business sector employees as reported in the National Income and Product Accounts by the total number of payroll hours in private nonagricultural establishments. The employee compensation figure in the National Accounts includes wages and salaries, employer contributions to social insurance programs such as Social Security and unemployment insurance, and other labor income such as employer contributions to private pension and welfare funds.[8]

As noted above, we entered either four or sixteen lagged inflation variables into all our regression models. As far as the choice of an appropriate price deflator series to use for constructing these lagged inflation terms, it is important to note that in a world with more than one commodity, the price series that is relevant for suppliers of labor will very likely differ from the price series that is relevant for demanders of labor. One would expect labor suppliers to be concerned about their earnings relative to the price of the bundle of commodities they consume, whereas labor demanders should be concerned about the wages they pay relative to their product prices. Using lagged inflation terms based on the Gross National Product (GNP) deflator thus seemed like a reasonable compromise between the price relevant to consumers and the price relevant to producers.

The Data Resources, Inc. (DRI) computer system was the source of all of the data and programs used in conducting the analyses under discussion. All of the reported regressions were fit on the DRI system with seasonally adjusted quarterly data for 1956:1 through 1980:3 and were estimated using a maximum likelihood correction for first-order serial correlation.[9]

Compensation Growth: Unutilized Supply versus Unsatisfied Demand

Table 1 presents compensation growth equations which include a single labor market variable and either four or sixteen lagged inflation terms based on the GNP deflator. The official unemployment rate, the prime age male unemployment rate, the help wanted index and the manufacturing quit rate are each entered in inverse form as alternative measures of labor market conditions. The unemployment rate variables consistently assume the expected positive sign and the unsatisfied demand variables uniformly take on the expected negative sign. The official unemployment rate coefficient is not statistically significant in the model with four lagged inflation terms; it achieves statistical significance in the model with sixteen lagged inflation terms.[10] All of the prime age male unemployment rate, help wanted index and manufacturing quit rate coefficients are statistically significant. The $\bar{R}^2$'s for the unsatisfied demand variable models are consistently larger than the $\bar{R}^2$'s for the unemployment rate models. This would seem to suggest that the unsatisfied demand variables work better than the unemployment rates we have used; however, the magnitude of the differences in $\bar{R}$'s between the two sets of models are small, so no strong conclusion regarding the relative strength of the various labor market variables seems warranted on this basis alone.[11]

Table 1. Compensation Growth Equations with either an Unemployment Variable or an Unsatisfied Demand Variable[a]

Independent Variables & Summary Statistics	Mean [S.D.]	Dependent Variable: (Percentage Change in Average Hourly Compensation During Quarter/100)[b,c]							
		Models with 4 Lagged Inflation Values Included as Explanatory Variables[d]				Models With 16 Lagged Inflation Values Included as Explanatory Variables[d]			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables									
1. 1/(official unemployment rate)	.193 [.047]	.012 (.009)	...	—	—	.025 (.011)	...	—	—
2. 1/(prime age male unemployment rate)[e]	.323 [.122]	...	.005 (.003)	—	—	...	.008 (.004)	—	—
3. 1/(corrected help wanted index)	.796 [.177]	...	...	-.007 (.002)	—	...	...	-.008 (.003)	—
4. 1/(manufacturing quit rate)	.572 [.157]	...	...	—	-.008 (.003)	...	...	—	-.009 (.003)
Statistics									
5. total effect of lagged inflation	...	.780 (.071)	.760 (.067)	.667 (.069)	.685 (.067)	.926 (.095)	.858 (.082)	.702 (.080)	.737 (.076)
6. ρ	...	-.089 (.115)	-.097 (.114)	-.128 (.112)	-.134 (.112)	-.112 (.121)	-.113 (.121)	-.142 (.119)	-.149 (.119)
7. $\bar{R}^2$	...	.520	.524	.554	.555	.543	.541	.565	.570

a. All regressions were fit with seasonally adjusted quarterly data for 1956:1 through 1980:3 (N=99) and were estimated using a maximum likelihood correction for first-order serial correlation.

b. The mean [S.D.] of the dependent variable is .015 [.006].

c. The numbers in parentheses below the coefficient estimates are standard errors.

d. The lagged inflation values are based on the Gross National Product deflator.

e. The prime age male unemployment rate is for men aged 25 through 54.

Table 2 presents compensation growth equations which include both an unemployment rate variable and either the inverse of the help wanted index or the inverse of the manufacturing quit rate. Once either of the unsatisfied demand variables has been controlled for, the inverse unemployment rate variables no longer retain their expected positive association with the rate of wage growth. In fact, the point estimates of the unemployment rate variable coefficients are uniformly negative, though never significant. The prime age male unemployment rate performs just as poorly as the official unemployment rate, even though some have argued that it is a better indicator of unutilized labor supply. In contrast, all of the coefficients on the two variables we have chosen as proxies for the level of unsatisfied demand, the inverse of the help wanted index and the inverse of the manufacturing quit rate, are of the expected negative sign and statistically significant.[12]

The Sensitivity of Our Results to Alternative Specifications

Thus far we have explicitly or implicitly made a number of assumptions about the "proper" specification of the compensation growth models we have estimated. Fortunately, our central conclusions appear to be quite robust with respect to alternative plausible specifications.

The key compensation growth ($\dot{w}/w$) models presented in the text included an unsatisfied demand variable (either the help wanted index or the quit rate) in inverse form ($1/d$). We chose this functional form because it matched the way the unemployment rate is usually entered in this sort of regression (as $1/u$) and because regressions with both d and d^2 as independent variables indicated that $\dot{w}/w$ increases with d at a decreasing rate. We did replicate all of the relevant Table 1 and Table 2 models with d or log d replacing $1/d$; our qualitative results were completely unaffected by this substitution.

Table 2. Compensation Growth Equations with Both an Unemployment Variable and an Unsatisfied Demand Variable Included[a]

Independent Variables & Summary Statistics	Mean [S.D.]	Dependent Variable: (Percentage Change in Average Hourly Compensation During Quarter/100)[b,c]							
		Models with 4 Lagged Inflation Values Included as Explanatory Variables[d]				Models with 16 Lagged Inflation Values Included as Explanatory Variables[d]			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables									
1. 1/(official unemployment rate)	.193 [.047]	-.011 (.012)	-.019 (.013)	...	...	-.010 (.019)	-.018 (.020)	...	...
2. 1/(prime age male unemployment rate)[e]	.323 [.122]	...	...	-.004 (.005)	-.008 (.005)	...	...	-.004 (.006)	-.007 (.007)
3. 1/(corrected help wanted index)	.796 [.177]	-.010 (.003)	...	-.010 (.004)	...	-.010 (.005)	...	-.010 (.005)	...
4. 1/(manufacturing quit rate)	.572 [.157]	...	-.013 (.004)	...	-.013 (.005)	...	-.013 (.005)	...	-.013 (.005)
Statistics									
5. total effect of lagged inflation	...	.615 (.089)	.600 (.087)	.632 (.081)	.626 (.077)	.624 (.169)	.617 (.155)	.649 (.123)	.657 (.110)
6. ρ	...	-.134 (.112)	-.152 (.112)	-.131 (.112)	-.148 (.112)	-.146 (.120)	-.158 (.120)	-.145 (.120)	-.159 (.120)
7. $\bar{R}^2$	...	.553	.560	.552	.560	.561	.568	.562	.570

a. All regressions were fit with seasonally adjusted quarterly data for 1956:1 through 1980:3 (N=99) and were estimated using a maximum likelihood correction for first-order serial correlation.

b. The mean [S.D.] of the dependent variable is .015 [.006].

c. The numbers in parentheses below the coefficient estimates are standard errors.

d. The lagged inflation values are based on the Gross National Product deflator.

e. The prime age male unemployment rate is for men aged 25 through 54.

Another question which might be raised concerning the results presented is whether the Perry-weighted unemployment rate might not be a better variable to use than either the official or the prime age male rate.[13] Through 1978:4, the last quarter for which we could calculate the Perry-weighted unemployment rate, the Perry-weighted and the prime age male unemployment rates were correlated .991. Not surprisingly, substituting the Perry-weighted rate for the prime age male rate did not alter the message of our results.

A third possibility we considered was that unemployment and/or our unsatisfied demand variables might affect $\dot{w}/w$ with some lag rather than concurrently. To determine whether allowing for delayed impacts would alter our central conclusions, we re-estimated each of the models in Table 1 and Table 2 with four lagged values of 1/u and four lagged values of 1/d added wherever a current value of 1/u or 1/d appeared. The sums of the coefficients on the 1/u variables and 1/d variables were uniformly very similar to the 1/u and 1/d coefficients in our original models.

A fourth specification issue which seemed potentially important was that, as has been suggested by Robert J. Gordon and George Perry, certain periods during the past two decades are likely to have had below or above average wage growth because of events which would not make their way into a normal wage growth model.[14] Respecified models which included dummy variables for each of three periods (1964:1 to 1966:2, when the Johnson guideposts were in effect; 1971:3 to 1972:4, the Nixon controls period; and 1974:2 to 1975:1, quarters during which our country witnessed very sharp increases in oil prices) produced conclusions no different than those based on the original regressions.

Another question which might be raised regarding our results is whether the higher rate of growth in hourly compensation associated with increases in either the help wanted index or the quit rate actually reflects higher base wage rates as opposed to greater use of overtime hours and thus more time worked for premium pay. From the point of view of understanding what factors lie behind inflation, the answer to this question may not be particularly important. Nevertheless, we did try adding a measure of average weekly overtime hours in manufacturing to each of those models which included an unsatisfied demand variable. The overtime hours variable was always completely insignificant and none of the affected 1/u or 1/d coefficients increased or decreased appreciably. It should also be noted that the inverse of this overtime hours variable performed in very much the same way as the inverse of the help wanted index or the inverse of the quit rate when used alone as a proxy for unsatisfied demand in models like those in Table 1 and Table 2.

A sixth issue which deserves mention is our choice of an inflation series to appear on the right hand side of our compensation growth models. We picked the GNP deflator in an attempt to strike a compromise between the prices most relevant to labor suppliers and the price most relevant to labor demanders. Redoing the Table 1 and Table 2 analyses with a more "supplier oriented" price index (the Implicit Consumption deflator, considered vastly superior to the Consumer Price Index because of its treatment of housing expenditures) and then again with a more "demander oriented" price index (the Wholesale Price index) changed none of our conclusions.

Thus, the central implications of the compensation growth equations reported in Table 1 and Table 2 appear to be quite robust with respect to

the precise model specification used. When entered separately, both unemployment and our unsatisfied demand variables perform in the expected fashion, with unemployment negatively and unsatisfied demand positively related to the rate of compensation growth, (although in every instance but one the $\bar{R}^2$'s in the unsatisfied demand models were larger than the $\bar{R}^2$'s in the comparable unemployment models). However, in equations which include both an unemployment rate variable and an unsatisfied demand proxy, only the unsatisfied demand variable matters. We will wait until Section III to discuss a possible interpretation of these results.

II. Observed Instability in the Phillips Curve Relationship

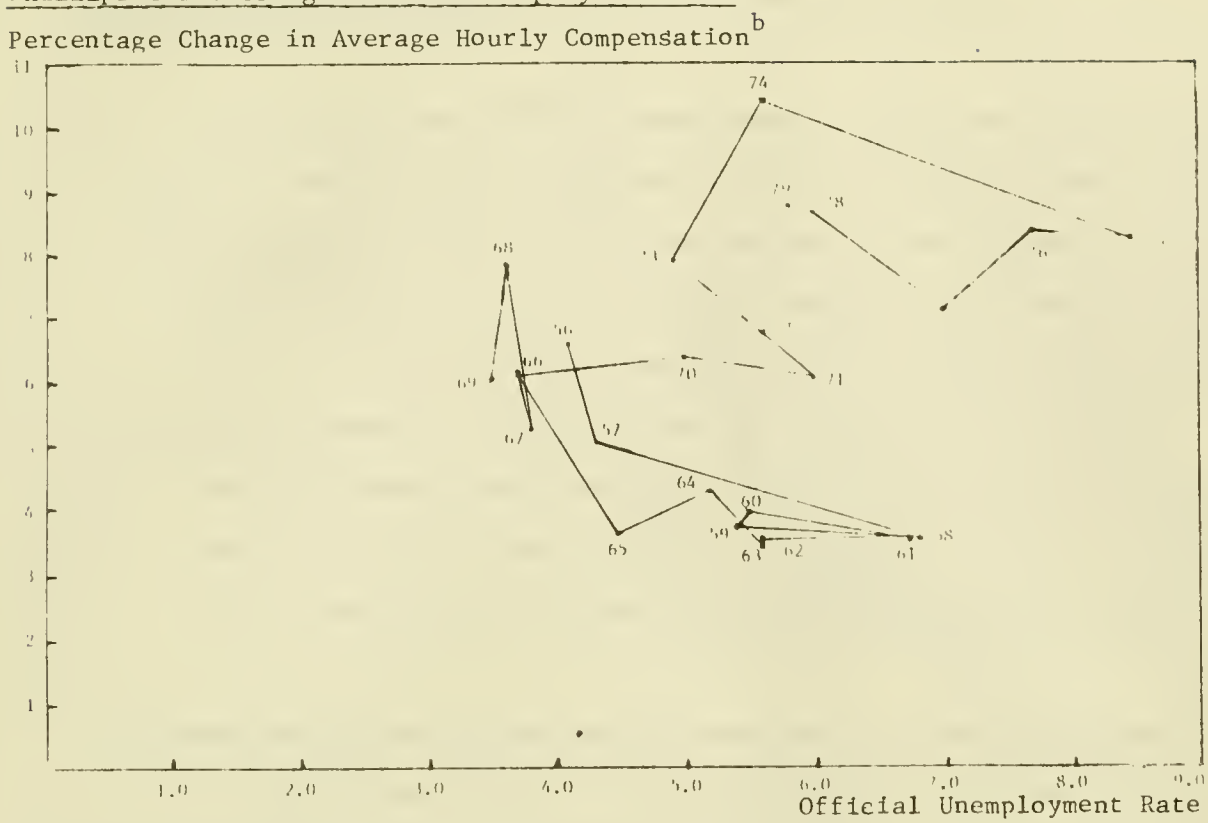
One empirical phenomenon which has received considerable attention during the past decade has been the breakdown in the Phillips relationship.[15] This event is consistent with the hypothesis of Milton Friedman and Edmund Phelps that revisions in inflationary expectations will cause outward shifts in the short run Phillips curve.[16] While inflation is clearly important, we believe that a substantial fraction of the outward shift in the Phillips curve may be linked to an outward shift in the inverse relationship between unemployment and the unsatisfied demand for labor. Furthermore, the relationship between unsatisfied demand and compensation growth appears to have been more stable than the relationship between unemployment and compensation growth.

Plots of the Shifting Phillips Curve

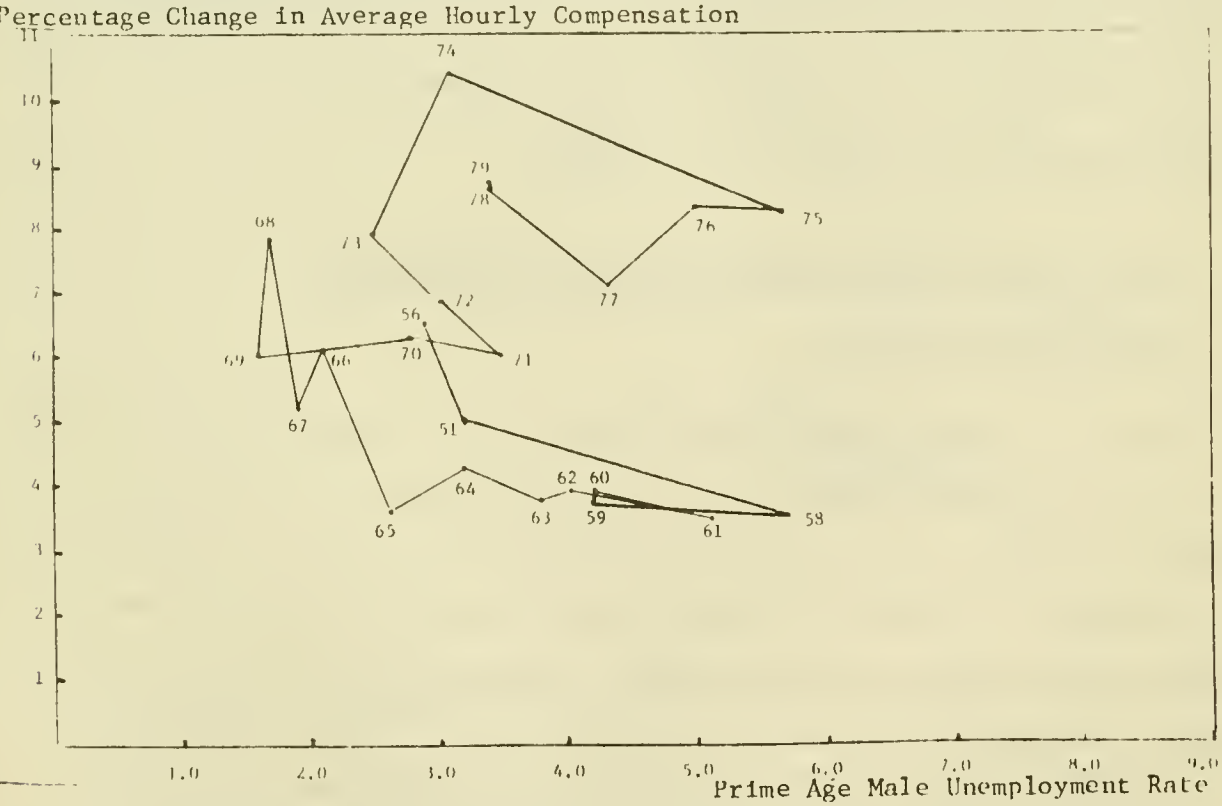
Figure 1A documents a fact that should be familiar to most readers: the rate of growth in compensation associated with any

FIGURE 1: PHILLIPS CURVES USING OFFICIAL AND PRIME AGE MALE UNEMPLOYMENT RATES[a]

1A. Phillips Curve Using Official Unemployment Rate



1B. Phillips Curve Using Prime Age Male Unemployment Rate



a. The official and prime age male unemployment rate variables are annual averages of seasonally adjusted monthly rates.

b. The percentage change in average hourly compensation variable is the percentage change in fourth quarter average hourly compensation between the given year and the preceding year.

given value of the official unemployment rate has been substantially higher since 1970 than prior to that date. The curve linking percentage change in average hourly compensation to the official unemployment rate appears to have shifted outward first in 1970 and then again in 1974; a smaller backward shift seems to have occurred after 1976.

As demonstrated in Figure 1B, the relationship between the rate of growth in compensation and the prime age male unemployment rate has exhibited a similar shift pattern. Sharp outward shifts in 1970 and 1974 appear to have been followed by a smaller backward shift after 1976.

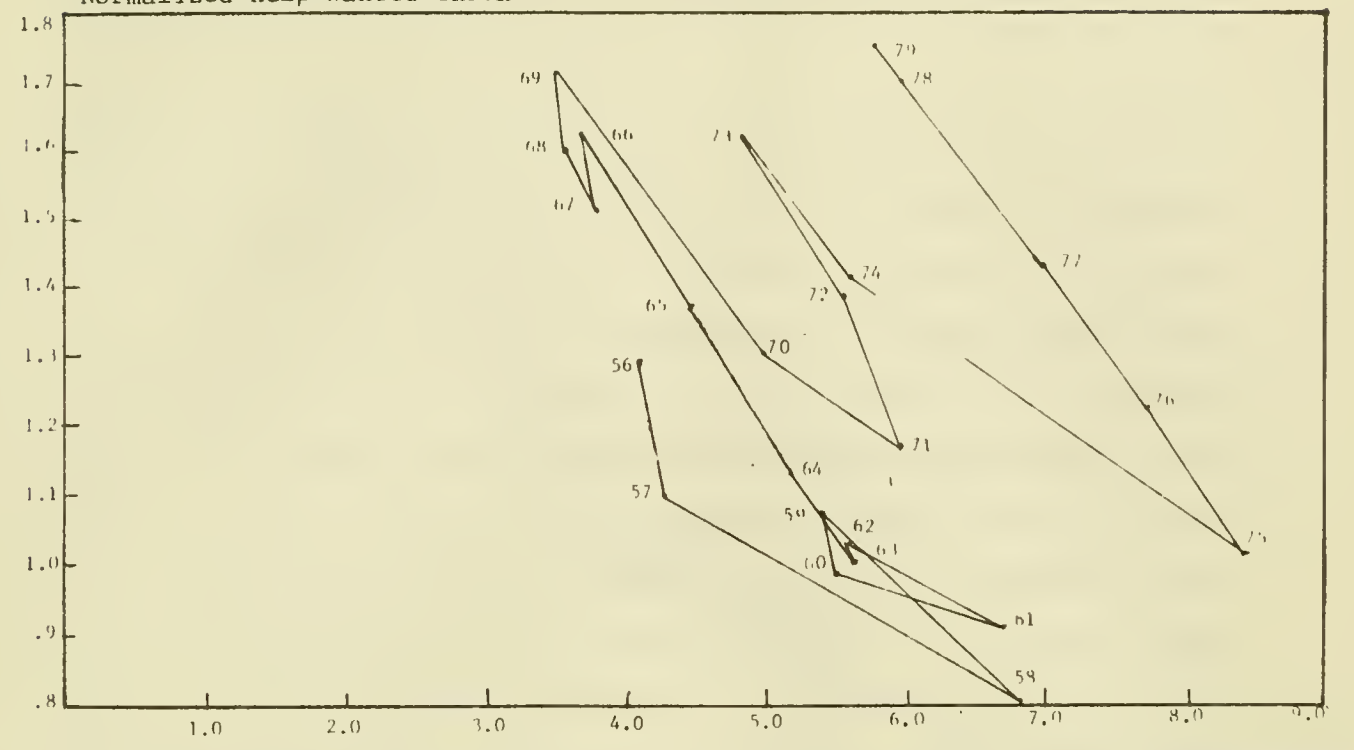
The question we are interested in answering is whether the observed shifts in both the official unemployment rate and prime age male unemployment rate Phillips relationships are somehow related to changes in the relationship between unemployment and unsatisfied demand. There is at least good circumstantial evidence which suggests that this question should be answered in the affirmative.

Plots of the Shifting Relationship Between Unemployment and Unsatisfied Demand

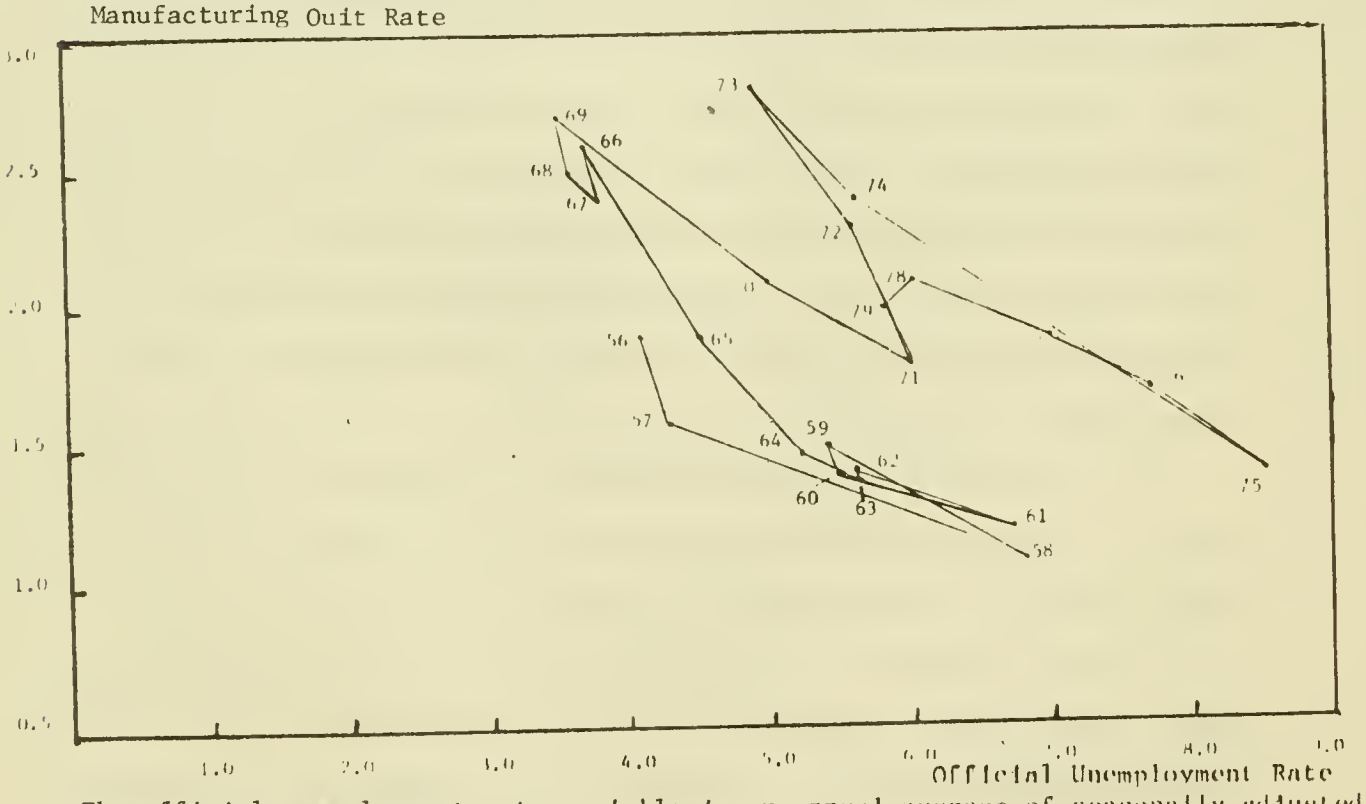
Figure 2 presents plots relating each of our two unsatisfied demand proxies for the United States, the normalized help wanted index and the manufacturing quit rate, to the official United States rate of unemployment. In both plots, the points from 1958 through 1969 seem to lie more or less along a single curve. Both plots exhibit a dramatic shift outward in 1970, which is when the first obvious outward shift in the official unemployment rate Phillips relation occurred.[17] The help wanted index versus official unemployment rate plot shifts sharply outward again after 1974, but the

FIGURE 2: SHIFTING UNSATISFIED DEMAND VARIABLE/OFFICIAL UNEMPLOYMENT RATE CURVES[a]

2A. Normalized Help Wanted Index vs. Official Unemployment Rate[b]



2B. Manufacturing Quit Rate vs. Official Unemployment Rate[c]



a. The official unemployment rate variable is an annual average of seasonally adjusted monthly rates

b. The normalized help wanted index was constructed by taking the average of the monthly seasonally adjusted help wanted index figures for each year and dividing by employees on nonagricultural payrolls.

c. The monthly quit rate variable is the annual average of seasonally adjusted monthly rates.

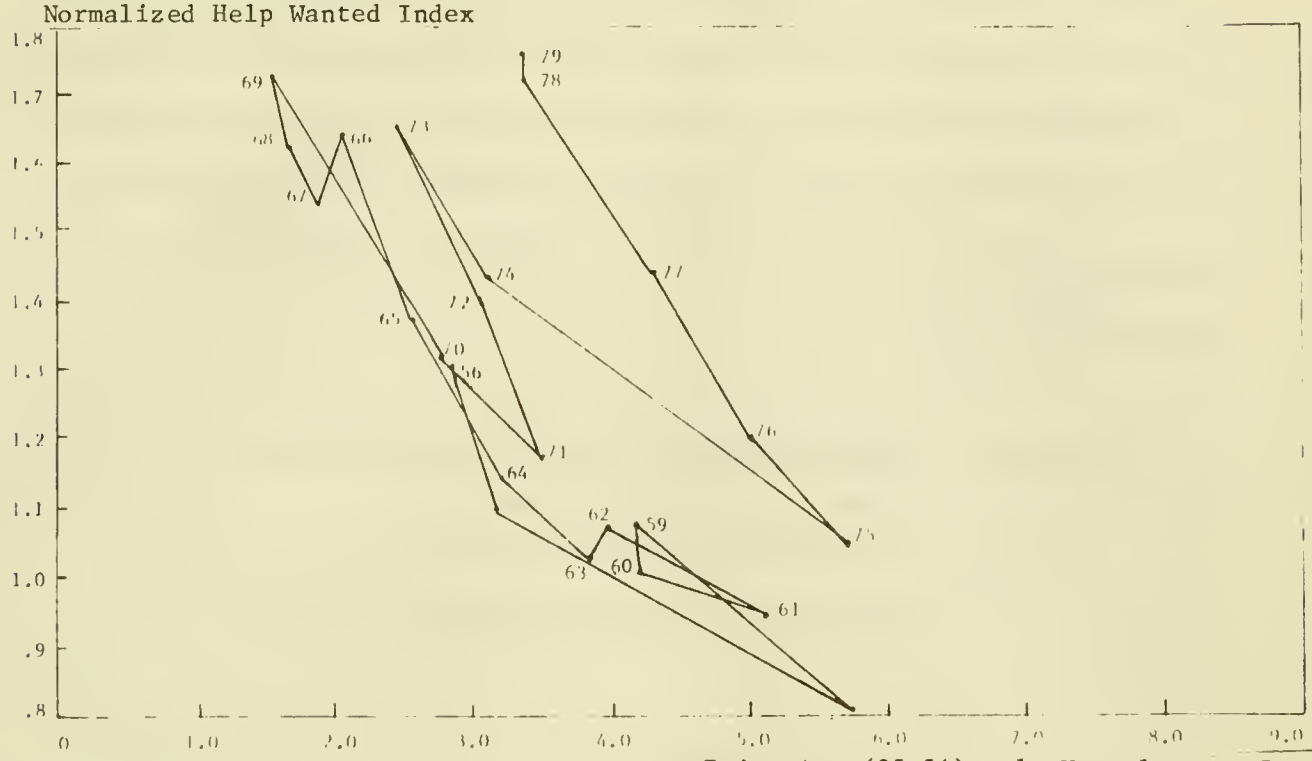
quit rate versus official unemployment rate plot does not. As was mentioned earlier, the volume of help wanted advertising may have increased during the middle and late 1970's because of increased affirmative action pressures; this could have caused the post-1974 shift in Figure 2A even if there were no shift in the underlying vacancy versus unemployment relationship. The outward shift in the official unemployment rate Phillips curve which occurred in 1974 thus might better be linked to the sharp increase in the price of oil around the same date than to labor market changes. The quit rate versus official unemployment rate plot may have shifted slightly backwards after 1977; no backward shift appears in the help wanted index versus official unemployment rate plot. As noted earlier, the official unemployment rate Phillips relation appeared to shift backward after 1976.

Figure 3 presents plots like those in Figure 2 , except with the prime age male unemployment rate substituted for the official unemployment rate. While the shifts in the Figure 3 plots are somewhat less pronounced than those in Figure 2, their timing is very similar. The same connections can be drawn between each of the two unsatisfied demand proxy versus prime age male unemployment rate plots and the prime age male unemployment rate Phillips curve plot as were drawn between the relevant pairs of official unemployment rate plots.

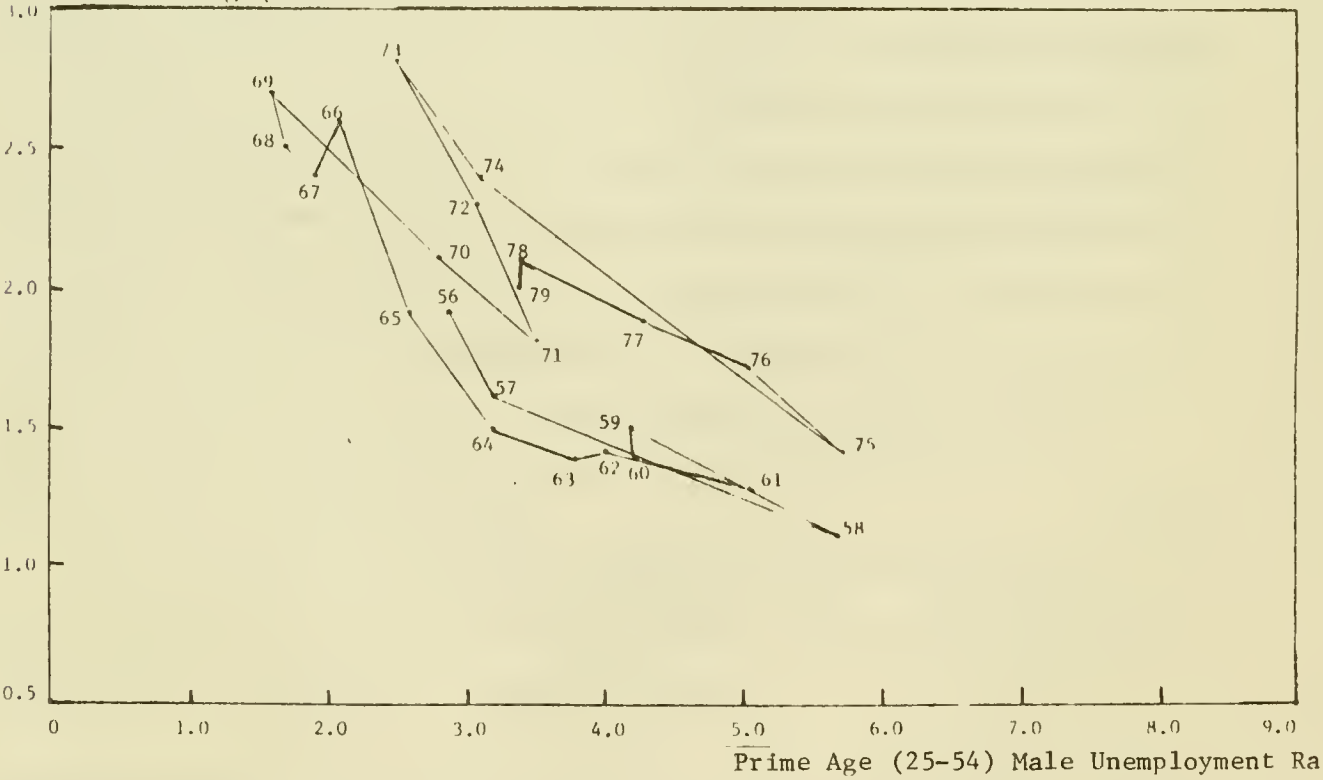
It is interesting to note that the relationship between unsatisfied demand and unemployment seems also to have been quite unstable in a large number of other developed countries. Beveridge curve (job vacancy rate versus overall unemployment rate) plots for Canada, the United Kingdom, Japan, France, Norway, Finland and Australia all clearly exhibit sharp outward shifts during the late 1960's and early 1970's.[18] It would be of considerable interest to conduct a careful exploration of whether these Beveridge curve shifts might also be linked to movements in the relevant countries' Phillips curves.

FIGURE 3: SHIFTING UNSATISFIED DEMAND VARIABLE/PRIME AGE (25-54) MALE UNEMPLOYMENT RATE CURVES[a]

3A. Normalized Help Wanted Index vs. Prime Age (25-54) Male Unemployment Rate[b]



3B. Manufacturing Quit Rate vs. Prime Age (25-54) Male Unemployment Rate[c]



a. The prime age male unemployment rate variable is an annual average of seasonally adjusted monthly rates.

b. The normalized help wanted index was constructed by taking the average of the monthly seasonally adjusted help wanted index figures for each year and dividing by employees on nonagricultural payrolls.

c. The monthly quit rate variable is the annual average of seasonally adjusted monthly rates.

While looking at pictures is interesting, quantifying the extent to which shifts in the United States' official unemployment rate and prime age male unemployment rate Phillips relationships might be linked to the shifting relationship between these unemployment variables and unsatisfied demand can perhaps better be accomplished econometrically. Let us turn to the appropriate regressions.

Econometric Evidence Regarding the Shifting Phillips Curve

To summarize the magnitude of the overall shift in the Phillips relations shown in Figures 1A and 1B, we estimated equations of the following form:

$$(4) \quad \dot{w}/w = \alpha + \beta(1/u) + \delta t,$$

where u is either the official or the prime age male unemployment rate and t is a time trend. The estimate of δ from the official rate regression indicates that the annual rate of wage growth associated with any given level of unemployment grew by approximately 6.1 percentage points between 1956 and 1980. Over the same period, the similarly estimated shift in the prime age male relationship was approximately 5.7 percentage points.

Adding an unsatisfied demand variable to equation (4) is one approach to estimating the extent to which these upward shifts can be linked to the changing relationship between unemployment and unsatisfied demand. The relevant regression is:

$$(5) \quad \dot{w}/w = \alpha + \beta(1/u) + \delta t + \gamma(1/d),$$

where d may be either the normalized help wanted index or the manufacturing quit rate and the other variables are as before. To the extent that the outward shifting of the relationship between $\dot{w}/w$ and $1/u$, indicated by $\delta>0$ in equation (4), can be linked to the shifting relationship

between 1/u and 1/d, the estimate of δ in equation (5) should fall toward zero. Introducing the normalized help wanted index variable into the official rate equation reduced the magnitude of the estimated time trend by 20 percent; adding the manufacturing quit rate variable reduced the official rate equation time trend by 29 percent. In the prime age male models, the introduction of the inverse of the help wanted index knocked the estimated time trend down by 23 percent and adding the inverse of the manufacturing quit rate lowered the estimated time trend by 25 percent. Thus, this approach suggests that between 20 and 30 percent of the observed upward shift in these Phillips relationships may be linked to the shifting relationship between unemployment and unsatisfied demand.

Econometrically estimated Phillips curves more typically include a variable or variables intended to capture the impact of the rate of inflation. In this paper we have focused primarily on augmented Phillips curve equations containing either four or sixteen lagged inflation terms. An alternative approach to assessing the role of the shifting relationship between unemployment and unsatisfied demand would be to look at the time trend remaining after lagged inflation terms have been introduced into the wage growth model, then to add an unsatisfied demand variable to see whether it can knock out the residual time time trend in the augmented model.

The first and fourth columns of Table 3 contain regressions of the following form estimated using the official unemployment rate and either four or sixteen lagged inflation terms:

$$(6) \quad \dot{w}/w = \alpha + \beta(1/u) + \sum_{j=1}^{n} \lambda_j (\dot{p}/p)_{t-j} + \delta t.$$

The point estimate of the time trend coefficient in the model with four

Table 3. Can Instability in the Relationship Between the Official Unemployment Rate and Unsatisfied Demand Variables Explain a Part of the Observed Instability in the Relationship Between the Official Unemployment Rate and the Rate of Growth in Compensation?[a]

Independent Variables and Summary Statistics	Mean [S.D.]	Dependent Variable: (Percentage Change in Average Hourly Compensation During Quarter /100)[b, c]					
		Models With 4 Lagged Inflation Values Included as Explanatory Variables[d]			Models With 16 Lagged Inflation Values Included as Explanatory Variables[d]		
		(1)	(2)	(3)	(4)	(5)	(6)
Variables							
1. time/100	.500 [.286]	.005 (.002)	.000 (.004)	.001 (.003)	.003 (.003)	-.003 (.004)	-.001 (.003)
2. 1/(official unemployment rate)	.193 [.047]	.016 (.009)	-.011 (.018)	-.017 (.018)	.022 (.011)	-.020 (.023)	-.019 (.021)
3. 1/(corrected help wanted index)	.796 [.177]	...	-.010 (.006)	...	...	-.014 (.007)	...
4. 1/(manufacturing quit rate)	.572 [.157]	...	...	-.012 (.006)	...	...	-.014 (.006)
5. lagged inflation; constant	...	yes	yes	yes	yes	yes	yes
Statictics							
6. total effect of lagged inflation	...	.582 (.114)	.616 (.113)	.588 (.109)	.764 (.202)	.700 (.195)	.649 (.197)
7. ρ	...	-.116 (.113)	-.134 (.113)	-.151 (.112)	-.117 (.121)	-.153 (.121)	-.160 (.121)
8. $\bar{R}^2$	...	.539	.548	.556	.542	.559	.563

a. All regressions were fit with seasonally adjusted quarterly data for 1956:1 through 1980:3 (N=99) and were estimated using a maximum likelihood correction for first order serial correlation.

b. The mean [S.D.] of the dependent variable is .015 [.006].

c. The numbers in parentheses below the coefficient estimates are standard errors.

d. The lagged inflation values are based on the Gross National Product deflator.

lagged inflation terms (column (1)) implies that the annual rate of wage growth associated with any given level of the official unemployment rate would have been approximately 2.1 percentage points higher in 1980 than in 1956, even if the four previous quarters' inflation rates had been the same. The point estimate of the time trend coefficient in the model with sixteen lagged inflation terms (column (4)) implies that the annual rate of wage growth would have been approximately 1.2 percentage points higher in 1980 than in 1956, again holding the official unemployment rate and the relevant inflation rate history constant. The coefficient in the model with four lagged inflation values is strongly significant, but when sixteen lagged inflation values are included in the model, the time trend coefficient loses its significance. The point estimates of these time trends are 66 percent and 81 percent smaller than the time trend in the crude Phillips curve with no lagged inflation terms based on the official unemployment rate, which means that a residual shift between 19 and 34 percent of the total remains to be explained.

If this residual shift is related to the outward shift in the relationship between unemployment and unsatisfied demand, then adding 1/d to equation (6), which gives:

$$(7) \quad \dot{w}/w = \alpha + \beta(1/u) + \sum_{j=1}^{n} \lambda_j (\dot{p}/p)_{t-j} + \delta t + \gamma(1/d)$$

should drive $\hat{\delta}$ to zero. Columns (2), (3), (5), and (6) of Table 3 report coefficient estimates for equations with either the inverse of the normalized help wanted index or the manufacturing quit rate added to our augmented Phillips equations based on the official unemployment rate. The point estimate of the time trend coefficient remaining after either of these unsatisfied demand variables has been introduced is either very close to zero or negative (in the

model with sixteen lagged inflation values to which the help wanted index has been added); none of these estimated time trend coefficients is statistically significant. The negative time trend in the model which includes sixteen lagged inflation terms and the normalized help wanted index might reflect the spurious increase in the level of the index relative to the vacancy rate which we suspect may have occurred after 1973 or 1974. In any event, the positive time trend in the augmented compensation growth models with just the inverse of the official unemployment rate but no unsatisfied demand variable does seem to disappear once some control for the level of unsatisfied demand has been introduced.

Qualitiatively similar results were obtained from augmented Phillips curve equations estimated based on the prime age male unemployment rate. The augmented Phillips curve equation with four lagged inflation terms presented in column (1) of Table 4 implies an upward shift between 1956 and 1980 of 1.7 percentage points in the annual rate of wage growth associated with any given unemployment rate (coefficient statistically significant). The comparable model with sixteen lagged inflation terms presented in column (4) implies an upward shift of 0.7 percentage points (coefficient estimate not significant). Thus, changes in the pattern of inflation would appear to account for between 71 and 88 percent of the total shift in the Phillips curve relation based on the prime age male rate of unemployment, leaving an unexplained residual of between 12 and 29 percent of the total.

As was true with the official rate equations, adding an unsatisfied demand variable to the augmented prime age male Phillips curve equations seems to knock out the positive residual time trend. When the help wanted index variable is introduced, the point estimates of the time trend

Table 4. Can Instability in the Relationship Between the Prime Age Male Unemployment Rate and Unsatisfied Demand Variables Explain a Part of the Observed Instability in the Relationship Between the Prime Age Male Unemployment Rate and the Rate of Growth in Compensation?[a]

Independent Variables and Summary Statistics	Mean [S.D.]	Dependent Variable: (Percentage Change in Average Hourly Compensation During Quarter /100)[b, c]					
		Models With 4 Lagged Inflation Values Included as Explanatory Variables[d]			Models With 16 Lagged Inflation Values Included as Explanatory Variables[d]		
		(1)	(2)	(3)	(4)	(5)	(6)
Variables							
1. time /100	.500 [.286]	.004 (.002)	.001 (.003)	.002 (.002)	.002 (.004)	-.001 (.004)	.001 (.003)
2. 1/ (prime age male unemployment rate)[e]	.323 [.122]	.005 (.003)	-.003 (.005)	-.007 (.006)	.007 (.004)	-.004 (.006)	-.007 (.007)
3. 1/ (corrected help wanted index)	.796 [.177]	...	-.009 (.005)	...	...	-.011 (.005)	...
4. 1/ (manufacturing quit rate)	.572 [.157]	...	...	-.012 (.005)	...	...	-.013 (.005)
5. lagged inflation; constant	...	yes	yes	yes	yes	yes	yes
Statistics							
6. total effect of lagged inflation	...	.594 (.115)	.604 (.112)	.570 (.110)	.766 (.211)	.711 (.203)	.623 (.206)
7. ρ	...	-.115 (.114)	-.131 (.113)	-.149 (.112)	-.114 (.121)	-.147 (.121)	-.158 (.121)
8. $\bar{R}^2$	...	.535	.548	.558	.536	.557	.564

a. All regressions were fit with seasonally adjusted quarterly data for 1956:1 through 1980:3 (N=99) and were estimated using a maximum likelihood correction for first order serial correlation.

b. The mean [S.D.] of the dependent variable is .015 [.006].

c. The numbers in parentheses below the coefficient estimates are standard errors.

d. The lagged inflation values are based on the Gross National Product deflator.

e. The prime age male unemployment rate is for men aged 25 through 54.

coefficents fall very near zero; adding the quit variable brings the point estimates of the time trend coefficients down by roughly 60 percent. None of the time trend coefficients in the equations which include an unsatisfied demand variable is statistically significant.

Taken as a whole, our econometric results seem supportive of the proposition that a substantial fraction of the total observed instability in the Phillips curve relations based on both the official and the prime age male unemployment rates can be linked to shifts in the relationships between those two variables and the level of unsatisfied demand.

The Relative Stability of the Relationship Between Unsatisfied Demand and Compensation Growth

At this point the question might be asked whether the relationship between unsatisfied demand (proxied by the help wanted index or the quit rate) and the rate of growth in compensation has been more stable than the relationship between unemployment and compensation growth. To answer this question, we first estimated equations of the following form:

$$(8) \quad \dot{w}/w = \alpha + \gamma(1/d) + \delta t,$$

which is just like equation (4) except with an unsatisfied demand variable (1/d) based on either the help wanted index or the manufacturing quit rate substituted for the unemployment rate variable (1/u). The estimate of δ from the help wanted index regression indicates that the annual rate of

wage growth associated with any given value of that variable increased by approximately 4.9 percentage points between 1956 and 1980; the estimate of δ from the quit rate regression implies a comparable upward shift of approximately 5.0 percentage points. These shifts are appreciably smaller than the 6.1 percentage point shift estimated for the official unemployment rate Phillips curve equation with no lagged inflation terms and the 5.7 percentage point shift estimated for the prime age male unemployment rate Phillips curve equation with no lagged inflation terms.

Throughout this paper, we have focused primarily on compensation growth equations which include a string of lagged inflation terms on the right hand side. Models with an unsatisfied demand variable, a time trend and lagged inflation terms:

$$(9) \quad \dot{w}/w = \alpha + \beta(1/d) + \sum_{j=1}^{n} \lambda_j (\dot{p}/p)_{t-j} + \delta t$$

are presented in Table 5. In both the help wanted index and the quit rate models with four lagged inflation values, the time trend coefficient has a positive point estimate but is not significant. Where the significant time trend coefficients in the comparable official and prime age male unemployment rate equations implied upward shifts of 2.1 and 1.7 percentage points, respectively, in the annual rate of inflation associated with given values of those variables, the insignificant time trend coefficients in these help wanted index and manufacturing quit rate equations imply smaller upward shifts of 0.7 and 1.1 percentage points, respectively. In models which include sixteen lagged inflation values, the time trend coefficient in the help wanted index equation is slightly negative but not significant and the time trend coefficient in the quit rate equation is extremely close to, and not significantly different from, zero. The slightly negative or zero

Table 5: How Stable is the Relationship Between Unsatisfied Demand Variables and the Rate of Growth in Compensation?[a]

Independent Variables and Summary Statistics	Mean [S.D.]	Dependent Variable: (Percentage Change in Average Hourly Compensation During Quarter /100)[b, c]			
		Models With 4 Lagged Inflation Values Included as Explanatory Variables[d]		Models with 16 Lagged Inflation Values Included as Explanatory Variables[d]	
		(1)	(2)	(3)	(4)
Variables					
1. Time/100	.500 [.286]	.002 (.003)	.003 (.002)	-.001 (.004)	.000 (.003)
2. 1/corrected help wanted index)	.796 [.177]	-.006 (.003)	...	-.009 (.003)	...
3. 1/(manufacturing quit rate)	.572 [.157]	...	-.007 (.003)	...	-.009 (.003)
4. lagged inflation; constant	...	yes	yes	yes	yes
Statistics					
5. total effect of lagged inflation	...	.606 (.112)	.588 (.110)	.762 (.182)	.732 (.176)
6. ρ	...	-.130 (.112)	-.140 (.112)	-.144 (.120)	-.149 (.120)
7. $\bar{R}^2$	...	.551	.556	.561	.564

a. All regressions were fit with seasonally adjusted quarterly data for 1956:1 through 1980:3 (N=99) and were estimated using a maximum likelihood correction for first order serial correlation.

b. The mean [S.D.] of the dependent variable is .015 [.006].

c. The numbers in parentheses below the coefficient estimates are standard errors.

d. The lagged inflation values are based on the Gross National Product deflator.

implied shifts in the help wanted index and quit rate equations with sixteen lagged inflation terms compare to 1.2 and 0.7 percentage point upward shifts in the analagous official and prime age male unemployment rate equations respectively, as discussed above. In spite of the problems with our measures of unsatisfied demand, the Phillips-type compensation growth equations in Table 5 which contain an unsatisfied demand proxy rather than an unemployment rate do appear to be relatively more stable than the comparable equations in Table 3 and Table 4.

We noted earlier that the help wanted index and the manufacturing quit rate are most certainly flawed measures of the level of unsatisfied demand for labor in the economy as a whole. It seems plausible that compensation growth equations estimated with a better unsatisfied demand variable, in particular a well measured job vacancy rate, should one become available, might exhibit even greater stability. Unfortunately, we cannot test this hypothesis at present.

The Sensitivity of Our Results to Alternative Specifications

In order to determine whether the conclusions just reached were robust with respect to alternative specifications, we reestimated the equations in Tables 3, 4 and 5 in each of the various ways we had previously reestimated the Table 1 and 2 equations, as described at the end of the first section of the paper: with d or log d replacing 1/d; with the Perry weighted unemployment rate rather than the prime age male unemployment rate; with the current and four lagged values of 1/u and 1/d instead of just the current value of each; with the three special period dummy variables added to the original models; with overtime hours added to all equations containing either the help wanted index or the quit

rate; with overtime hours used instead of the help wanted index or the quit rate as our unsatisfied demand variable; and with lagged values of either the implicit consumption deflator or the wholesale price index replacing lagged values of the gross national product deflator. The conclusions implied by these alternative sets of models were quite similar to the conclusions implied by the results we originally presented: in all of the models with four lagged inflation values and in all but one set with sixteen lagged inflation values, the standard augmented Phillips curve seemed to have shifted upwards over time, sometimes by substantially more than in the models discussed in the text; introducing an unsatisfied demand proxy into the standard Phillips equations always reduced the point extimate of the time trend coefficient; and the equations with only unsatisfied demand variables seemed for the most part to have been more stable than those with only unemployment rates.

How should these results be interpreted? How do they relate to the evidence presented in Section II? In the next section we discuss the interpretation of our findings.

III. Interpretation of Findings

Thus far, we have presented empirical results without seriously addressing the issue of their proper interpretation. In this section we first lay out one plausible interpretation of our findings, that the unemployment rate is a poor measure of the effective unutilized supply of labor. We then discuss some of the potential reasons why the relationship between measured unemployment and effective unutilized labor supply has not been stable.

A Possible Explanation

Suppose the effective unsatisfied demand for labor and the effective unutilized supply of labor to have been stably correlated with one another. If the rate of growth in wages had been a stable function of effective unsatisfied demand and/or effective unutilized supply (for example, the rate of wage growth might depend of $d - s$, $\alpha d - \beta s$, d alone or s alone, where d represents effective unsatisfied demand and s effective unutilized supply), then good measures of either variable should serve equally well in wage growth regressions. One potential explanation of our findings can be built on the premise that available unemployment rates do not provide consistent measures of the effective unutilized labor supply. In particular, it can be hypothesized that the effective unutilized labor supply associated with any given unemployment rate has fallen over time.

Why might there have been a divergence between the unemployment rate and the effective unutilized supply of labor? Two sorts of possible changes in the labor market suggest themselves as potentially relevant: either the number of units of available labor represented by the typical unemployed person may have fallen or the mismatch between the skills of unemployed persons and the skills required to fill available jobs may have become more serious over time.

What does it mean to say that the typical unemployed person might represent fewer units of available labor today than previously? Examples of the sort of problem we have in mind here include declines in the average number of hours the unemployed wish to work per week or changes in the attitudes of the unemployed so that they are less eager to secure employment. In principle, one could deal with these problems by developing

an appropriate correction factor for each time period; the corrected period t unemployment rate would simply equal the raw period t unemployment rate times the fraction of a typical base year unemployed person's labor supply represented by the typical period t unemployed person. In the absence of such a correction, the cited problems would be expected lead to an increase in the amount of unsatisfied demand associated with any given unemployment rate.

Alternatively, available unemployment rates might not represent consistent measures of the effective unutilized labor supply because of growth in the importance of structural imbalance. One might suppose that the perceived availability of workers qualified to fill existing jobs should be reflected in the difficulty which employers experience in filling those jobs. To the extent that the piece of the unemployment rate which captures what employers know about the potentially usable unutilized labor supply is reflected in measures of unsatisfied demand, the residual piece of the unemployment rate which is uncorrelated with unsatisfied demand would tell us only about the amount of irrelavant unutilized labor supply.

For either of the above sources of divergence between the unemployment rate and the effective unutilized supply of labor to explain our results, we must further suppose the normalized help wanted index and the manufacturing quit rate to measure the effective unsatisfied demand for labor more consistently than the unemployment rate measures the effective unutilized supply of labor. The existence of greater total measurement error in the unemployment rates we have used than in our unsatisfied demand proxies would be consistent with our result that in wage growth equations which include both, unsatisfied demand variables matter but unemployment rates

do not. A positive time trend in the error with which unemployment captures the effective unutilized supply, that is, a decline in the effective unutilized labor supply associated with any given level of unemployment, could explain the positive time trend in estimated Phillips relationships. Furthermore, if the trend in the measurement error in unemployment rates is greater than the comparable trend in our unsatisfied demand proxies, then a measurement error story could be used to explain the somewhat greater stability of Phillips curves defined in terms of unsatisfied demand proxies instead of unemployment rates. Most of our results can thus be explained in terms of a simple time trend measurement error in unemployment rates. However, a simple trend-related error could not explain our finding that, even after a time trend is entered into wage growth models, unsatisfied demand proxies still dominate unemployment rates when both are present. To explain this result, one must further suppose there to be some non-trend-related measurement error in unemployment rates which is greater than the comparable error in our unsatisfied demand measures. However, any non-trend-related error would not have to be just noise. For example, a one-time shift in the meaning of the unemployment rate as a measure of the effective unutilized labor supply would be imperfectly captured by a simple time trend, leaving a non-trend-related error component.

While the story we have just told seems plausible, a measurement error interpretation of our results may be suspect insofar as it is easy to believe that our unsatisfied demand proxies might be at least as poorly measured as our indicators of unutilized labor supply, the official and prime age male unemployment rates. As stated above, affirmative action considerations and other factors are likely to have caused some upward

trend in the ratio of help wanted advertising to effective unsatisfied labor demand. In addition, neither of our unsatisfied demand proxies fully reflects all sectors of the economy. The help wanted index is based on newspaper advertising and some types of job vacancies may be more likely to be advertised than others; the quit rate we have used is based on data for just the manufacturing sector. Any divergence between the degree of effective unsatisfied demand for labor in the sectors covered by our surrogates and the degree of effective unsatisfied demand for labor in the economy as a whole would cause measurement error problems with our proxies. For this reason, we are somewhat hesitant to assert that the story given above offers the best possible explanation of our findings.

The Shifting Relationship Between Unsatisfied Demand and Unemployment

Suppose it to in fact be true that the relationship between the effective unsatisfied demand for labor and the effective unutilized supply of labor has remained stable over time and that our unsatisfied demand proxies provide consistent measures of the effective unsatisfied demand for labor. Knowing why the relationship between our unsatisfied demand proxies and unemployment has shifted outward should then tell us why the unemployment rate has not been a consistent measure of the effective unutilized supply of labor and thus why the unemployment rate is dominated by measures of unsatisfied demand in wage growth equations. While we cannot fully explain the observed outward shift in the relationship between our unsatisfied demand proxies and unemployment, some of the likely causes of the shift can be identified.

Readily available data can document that significant demographic and unemployment insurance program changes have occurred in the United States during the period we are studying.[19] The proportion of the labor force between 25 and 54 fell from a 1956 to 1960 average of 66 percent to a 1976 to 1980 average of 61 percent. Female labor force participation grew so that women accounted for an average of 33 percent of the total labor force during the 1956 to 1960 period and an average of 42 percent during the 1976 to 1980 period. If the 1956 to 1960 period is compared to the 1976 to 1980 period, we observe that employment covered under state unemployment insurance (UI) programs grew from an average of 78 percent of non-federal civilian wage and salary workers to an average of 93 percent, accompanied by a roughly constant average potential duration of benefits for all UI claimants (23.5 weeks versus 23.2 weeks) and a slight increase in the ratio of average weekly UI benefits to average weekly wages of covered employees (from .34 to .37).[20] Unfortunately, hard data on other potentially important changes are not so readily accessible.

Changes in the demographic composition of the labor force do seem to have played an important role in shifting the relationship between our unsatisfied demand variables and the official unemployment rate. As noted before, the shifts in the plots of the unsatisfied demand proxies against the prime age male unemployment rate appear to be less pronounced than the shifts in the comparable official unemployment rate plots. To summarize the magnitude of the shifts in these relationships, we estimated equations of the following form:

$$(10) \quad d = \gamma + \phi u + \psi t,$$

where d represents either the normalized help wanted index or the manufacturing quit rate, u represents either the official or the prime age male unemployment rate and t is a time trend. The time trend coefficients imply that the shift of the normalized help wanted index was approximately 32 percent smaller against the prime age male unemployment rate than against the official unemployment rate and that the shift of the manufacturing quit rate was approximately 40 percent smaller against the prime age male unemployment rate than against the official unemployment rate. This would seem to suggest that the changing age and sex structure of the labor force may account for a substantial fraction of the shift in the official rate curves. We also estimated a more complete set of models of the same form as equation (10), except with u equal in turn to the official unemployment rate, the prime age unemployment rate, and the prime age male unemployment rate. The time trend coefficients from the male (prime age male) unemployment rate curves were compared with those from the official (prime age) unemployment rate curves to assess the effect of changes in the sex structure of the labor face; the time trend coefficients from the prime age (prime age male) unemployment rate curves were held up against those from the official (male) unemployment rate curves to gauge the impact of changes in the age structure of the labor force. On the basis of these comparisons, it would appear that changes in sex structure are associated with factors which can explain between one quarter and one third, and changes in age structure with factors which can explain between two thirds and three quarters, of the difference between the magnitude of the outward shifts in the unsatisfied demand proxy/official unemployment rate curves and the magnitude of the less pronounced outward shifts in the unsatisfied demand proxy/prime age male unemployment rate curves.[20]

It is perhaps worth noting that shifts in the relationship between unsatisfied demand and unemployment occurring because of changes in demographic structure might reflect either a change in the number of available units of labor represented by the typical unemployed individual or increased structural imbalance. On the one hand, women, youth or older persons might desire to work fewer hours per week or be less committed to finding and keeping a job than others. On the other hand, these people might simply be less likely to possess (or be perceived by employers as less likely to possess) requisite job skills. To say the same thing in a slightly different way, the elasticity of substitution between prime age male workers and other workers might be infinite but with a prime age male worker equivalant on average to a larger number of effective labor units, or alternatively, the elasticity of substitution between prime age males and others might be less than infinite.

It seems likely that changes in UI coverage and benefits may have played a substantial role in shifting the relationship between unsatisfied demand and measured unemployment. While an investigation for the U.S. has not yet been completed, research for Canada and Great Britain has linked outward shifts in those countries' Beveridge curves (which plot the vacancy rate versus the unemployment rate) to changes in the relevant UI laws.[22] Increased generosity of UI benefits is commonly supposed to affect the eagerness of the typical unemployed worker to secure new employment.

Other factors, such as a growing mismatch between the requirements of vacant jobs and the skills of the unemployed, even beyond what might have been expected given observed demographic changes, appear likely to have also played important roles in the phenomenon under discussion.[23] Unfortunately, at this point we cannot document how large the role of each of the potentially important factors might be.

IV. Conclusions and Directions

This paper has presented two key facts which call into question the value of unemployment rates as barometers of labor market tightness. First, while both unemployment rates and unsatisfied labor demand proxies perform reasonably well on their own in compensation growth equations, in models which include both, only the unsatisfied demand variable appears to matter. Second, the past decade's outward shifts in Phillips plots can to a substantial degree be tied to outward shifts in plots pairing the relevant unemployment rate and unsatisfied demand proxies. We also found that Phillips relationships which are defined in terms of unsatisfied demand variables appear to be somewhat more stable than those using unemployment rates.

Taken together, our findings have a clear message for those concerned with macroeconomic theory and policy: measures of employers' unsatisfied demand dominate unemployment rates as indicators of how labor market conditions are likely to affect wage growth.

Before the 1970's, the choice between various indicators of labor market tightness had little practical consequence, since the relationship between unsatisfied demand proxies and unemployment rates was so stable. Moreover, without some independent variation in the potential tightness indicators, it was not possible to determine which was "best." This all changed in the past ten years when relationships between unsatisfied demand proxies and unemployment rates broke down in many countries throughout the world. This event has allowed us to peek inside the black box which links unemployment rates and compensation growth. This glimpse has revealed that unemployment rates affect wage

growth only to the extent that they are correlated with unsatisfied labor demand and has raised very basic questions about the whole wage growth process.

For us to fully understand the determinants of wage growth in our country, it would seem that the following queries must be addressed: How exactly does a wage-setting unit determine the rate of wage growth? Which factors are central and which are tangential in this process? What information is available to those determining wages? Does the shifting during the past decade of the curves which link unsatisfied demand proxies and unemployment rates reflect a diminished desire to work or growing structural unemployment? Thus, it appears to us that an analysis of the issues at hand has as a prerequisite the collection of new microdata.

This paper has demonstrated that labor market pressure on wages can be more reliably assessed by looking at measures of unsatisfied labor demand than by looking at the unemployment rates which have played the key role in most earlier analyses. However, for now, our understanding of the reasons for this finding must remain incomplete. Nevertheless, we are confident that the collection and analysis of microdata can lead to a solution of this macro puzzle.

Footnotes

1. The seminal work in this area was A. W. Phillips' article, "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957", Economica, vol. 25 (November 1958), pp. 283-299.

2. This statement of the standard rationale for including an unemployment rate variable in wage growth models is taken from William Nordhaus, "The Worldwide Wage Explosion", Brookings Papers on Economic Activity, 2:1980, p. 442.

3. Since 1947, Joseph Livingston, a journalist, has conducted a small semi-annual survey of economists. Among other questions, on each survey occasion he has asked these economists what they anticipate the level of the CPI and the WPI will be roughly 6 and 12 months later. Given certain assumptions, these level forecasts can be converted into rate-of-inflation forecasts. There are a number of problems with these predicted rates of inflation, perhaps the most serious of which for our purposes is that economists are hardly a random sample of the population.

4. Based on tenure data collected as part of the Current Population Survey program, Robert Hall estimates that almost 60 percent of all currently employed workers hold jobs which will end up lasting 5 years or more and that nearly 30 percent hold jobs which will end up lasting 20 years or more. See Robert E. Hall, "The Importance of Lifetime Jobs in the U.S. Economy", Working Paper No. 560 (National Bureau of Economic Research, October 1980).

5. More details on the specifics of the procedure followed in creating the index can be found in the Conference Board publication, The

Help Wanted Index: Technical Descriptions and Behavioral Trends (New York: The Conference Board, 1977).

6. The need for normalization is discussed in Malcolm Cohen and Robert Solow, "The Behaviour of Help-Wanted Advertising", Review of Economic Statistics, vol. 49 (February 1967), pp. 108-110. They normalized with the civilian labor force rather than employment. Our results are quite insensitive to the choice between these two deflators.

7. See U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Methods, Bulletin 1910 (GPO, 1976), pp. 43-48, for a discussion of the "Monthly Report on Labor Turnover".

8. The construction of the employee compensation figures we used is not at the time of this writing described in print, although the Department of Commerce will soon publish a volume describing the derivation of each element in the National Accounts. Discussion with individuals at Commerce indicated that the series was produced with wage and supplements information from various tax forms, censuses, records of some private sector venders, and files of some professional and trade associations. The total payroll hours data used in converting these figures to hourly rates came from the "Monthly Report on Employment, Payroll and Hours", which is discussed on pp. 26-42 of U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Methods.

9. We did estimate all of the models reported in the tables of this paper without any serial correlation correction. The Durbin-Watson statistics for these equations were often such that we could not readily determine whether or not the presence of an autoregressive error process was indicated;

to be on the safe side, we chose to present models incorporating a serial correlation correction. The parameter estimates in the corrected models were very similar to those in the ordinary least squares models.

10. Throughout this paper, when we say a variable is statistically significant, we mean that it has passed at least a .05 level one-tailed test.

11. Earlier papers in which variables such as the manufacturing quit rate, the manufacturing layoff rate or the help wanted index have been substituted for the unemployment rate in wage growth models include Sara Behman, "Wage Determination Process In U.S. Manufacturing", Quarterly Journal of Economics, vol. 82 (February 1968), pp. 117-142; Charles L. Schultze, "Has the Phillips' Curve Shifted? Some Additional Evidence", Brookings Papers on Economic Activity, 2:1971, pp. 452-467; and Martin N. Baily and James Tobin, "Macroeconomic Effects of Selective Public Employment and Wage Subsidies", Brookings Papers on Economic Activity, 2:1977, pp. 511-541. Each of the cited articles concludes that the demand side variable or variables experimented with perform as well or better than the unemployment rate in manufacturing sector (Behman) or aggregate (Schultze, Baily and Tobin) wage growth equations. Although Baily and Tobin also present results for different sectors of the economy, these findings seem irrelevant for the present discussion since information on help wanted advertising does not exist at the sectoral level.

12. The results presented in Table 2 are consistent with earlier findings reported by Martin Baily and James Tobin. They estimated several aggregate wage growth equations using quarterly data for 1958:1 through 1976:4 which included both an inverse unemployment rate variable

and the help wanted index deflated by total employment; while their model specification is otherwise rather different from ours, they also obtain generally insignificant wrong-signed unemployment coefficients and strongly significant right-signed help wanted index coefficients. Baily and Tobin also present similar equations for different sectors of the economy; again, we would argue that these findings are not relevant for the present discussion since information on help wanted advertising does not exist at the sectoral level. See Baily and Tobin, "Macroeconomic Effects of Selective Public Employment and Wage Subsidies."

13. For a description of the Perry-weighted unemployment rate, see George L. Perry, "Changing Labor Markets and Inflation", Brookings Papers on Economic Activity, 3:1970, pp. 415-416 and pp. 439-440.

14. See George L. Perry, "Inflation in Theory and Practice", Brookings Papers on Economic Activity, 1:1980, pp. 207-241, and Robert J. Gordon, "Can the Inflation of the 1970's Be Explained?", Brookings Papers on Economic Activity, 1:1977, pp. 253-277.

15. Instability in the Phillips curve may take the form of shifts in the intercept or changes in the slope. Here we consider shifts in the intercept. For analyses suggesting that the United States' Phillips curve has been much flatter since World War II than earlier,

see Philip Cagan, "Changes in the Recession Behaviour of Wholesale Prices in the 1920's and Post-World War II", Explorations in Economic Research, vol. 2 (Winter 1975), pp. 54-104, and Jeffrey Sachs, "The Changing Cyclical Behavior of Wages and Prices: 1890-1976", American Economic Review, vol. 70 (March 1980), pp. 78-90. Any flattening in the Phillips curve which may have occurred during the post-war period appears to have been substantially less pronounced.

16. See Milton Friedman, "The Role of Monetary Policy", American Economic Review, vol. 58 (March 1968), pp. 1-17, and Edmund S. Phelps, "Phillips Curves, Expectations of Inflation and Optimal Unemployment Over Time," Economica, vol. 34 (August 1967), pp. 254-281.

17. Schultze, "Has the Phillips' Curve Shifted? Some Additional Evidence", looks at quit rate and official unemployment rate data for the period 1952 through 1971. The article reports that the curve linking these two rates seems to shift outwards in about 1966 and argues that this points to a shift in the Phillips relationship likely having occurred. This last 1960's shift is not obvious in our quit rate/official unemployment rate plot in part because we omit the data points for 1952 through 1955 so as to be consistent with the time period covered by our regression analysis and in part because the shift in the quit rate/official unemployment rate relationship which occurred after 1969 was much larger than any shift occurring during the late 1960's

18. See Organization for Economic Co-Operation and Development, Medium-Term Strategy for Employment and Manpower Policies (Paris: OECD, 1978), pp. 104-105.

19. Perry, "Changing Labor Markets and Inflation", was the first to emphasize the importance of the growing proportion of women and teenagers in the labor force in the context of understanding the relationship between unemployment and wage growth.

20. The figures pertaining to the participation rates of teens and women come from the relevant DRI data bank. The UI program statistics were provided by the Employment and Training Administration.

21. Katharine Abraham is currently exploring a cross-section/time-series data set which may shed additional light on the role played by demographic changes in shifting the relationship between unsatisfied demand and unemployment. Preliminary results seem supportive of the proposition that changes in age structure have been more important than changes in sex structure.

22. See, for example, Frank Reid and Noah M. Meltz, "Causes of Shifts in the Unemployment-Vacancy Relationship: An Empirical Analysis for Canada", Review of Economics and Statistics, vol. 61 (August 1979), pp. 420-425, and "The Changed Relationship Between Unemployment and Vacancies", Appendix H, British Labour Statistics 1976 Yearbook, which discuss the shifts in the Canadian and British Beveridge curves sources are cited in these articles. The cross-section/time series data set current being explored by Katharine Abraham may yield insight into the role of unemployment insurance changes in explaining shifts in the relationship between unsatisfied demand and unemployment in the United States. Preliminary results seem to support the proposition that increases in the percent of employment covered by unemployment insurance have played an important role.

23. For relevant discussion, see, for instance, William Winpisinger, "Correcting the Shortage of Skilled Workers," AFL-CIO Federationist, vol. 87 (June 1980), pp. 21-25; W. H. Weiss, "Help Wanted: The Skill Shortage - What Can Be Done About It?", Supervision, vol. 41 (July 1979), pp. 4-5; and R. B. Freeman, The Overeducated American (New York: Academic, 1976), pp. 51-73.

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